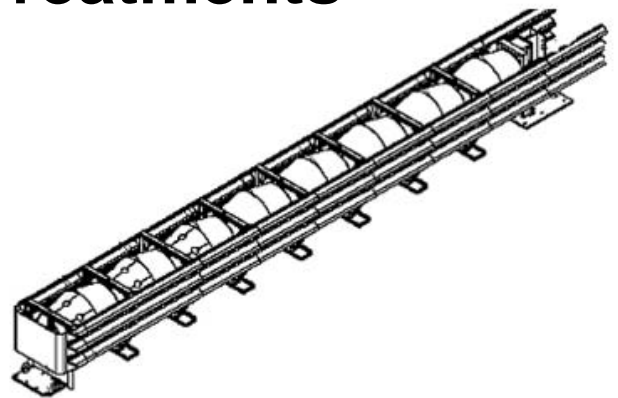
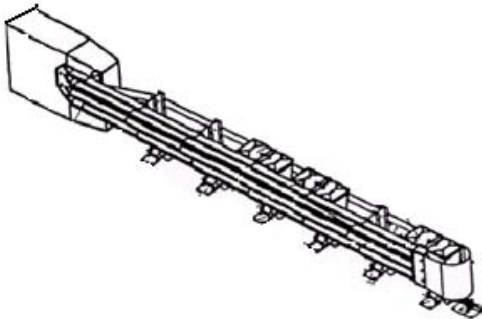


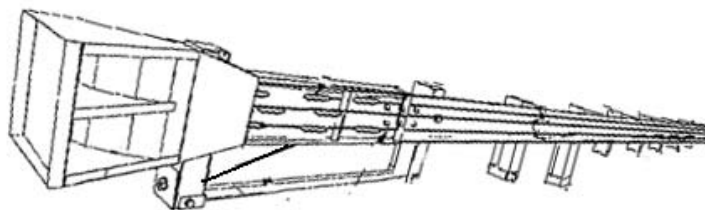
UTAH DEPARTMENT OF TRANSPORTATION



2007 Guidelines for Crash Cushions & Barrier End Treatments



APPROVED PRODUCTS LIST
Effective December 15, 2006



UTAH DEPARTMENT OF TRANSPORTATION

Guidelines for Crash Cushions & Barrier End Treatments

APPROVED PRODUCTS LIST

PREPARED BY THE DIVISION OF TRAFFIC & SAFETY

DATED December 15, 2006

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UDOT Guideline for Crash Cushion and Barrier End Treatments

INTRODUCTION

December 1, 2006

UDOT has adopted NCHRP 350 testing Basic TL-3 as the standard for crash cushions. Testing is done using a minimum of two types of production model vehicles, a small car and a pickup truck at a nominal speed of 60 MPH. Each device must pass a minimum number of tests in order to receive FHWA certification as a compliant system. More information about the testing requirements can be found in NCHRP Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features. All systems listed in this guide have been approved for use on the State and National Highway Systems.

A designer may designate any one system for a project, when there is a choice of more than one system, but must submit a letter of public interest explaining why this is the preferred system. The letter will be sent to the Traffic & Safety Operations Engineer, Division of Traffic & Safety. The Traffic & Safety Operations Engineer will forward it, with recommendation, to the Federal Highway Administration for approval. The approved letter will be placed in the project file.

These guidelines will list the type of crash cushion or barrier end treatment, a brief description, application and the manufacturer's name with the local supplier identified.

Systems identified, as construction zone systems will not be used in a permanent application without prior approval from the Traffic & Safety Operations Engineer, Division of Traffic & Safety.

Each approved crash cushion will have the following information:

NCHRP Test Level: the level a system has passed NCHRP 350 testing.

TL-1 \leq 40 MPH

TL-2 \leq 45 MPH, (TL-2 + \leq 50 MPH, TL-2 + \leq 55 MPH, Utah designation)

TL-3 \geq 60 MPH

Crash Cushion Types A, B, D can be configured to meet varying design speed criteria. Some manufacturers offer systems that can be configured to meet varying speed requirements. Systems which can be configured for speed greater than 45 MPH but less than 60 MPH will have a TL-2 + designation.

Some manufacturers offer systems that exceed TL-3, FHWA does not require the use of these systems.

Designers will not specify higher speed systems for installation.

Suppliers will bid only systems to the capacity as designated in these Guidelines.

Types C, F, G and H are all TL-3 systems.

Type E, sand barrel arrays will be configured to meet the design speed of the roadway they are being placed on.

Length: the length of the system based on the speed of the facility and the width of hazard.

Width: width design varies between manufacturer's, some supplying standard width and others using custom design. Those systems with a width designation (ie: 30"), this is the inside measurement of the system and the maximum hazard width the system can protect. Two systems, TRACC and SCI, use addition transition panels to obtain the require width. Caution should be used when these systems are supplied to insure the required approach to the system is maintained.

LON: Length Of Need indicates that portion of the system that can be included as part of the barrier LON requirement.

Characteristics: the manner in which the system has been designed to perform.

Application: a statement that lists some of the appropriate uses, requirements and Standard Drawings applicable to the system.

Requirements: conditions needed to insure proper operation of the system. Special requirements may be needed to handle drainage, or specific grading requirements for the systems. If there are special circumstance or requirement contact the Traffic & Safety Operations Engineer.

Offset: (guardrail approved systems) the distance from the lateral distance of the barrier line, extended to the front of the system.

SYSTEM TYPES & DESCRIPTION

Summary Table of Approved Crash Cushions For Permanent Application

CRASH CUSHIONS		
Type A: Primarily to protect wide fixed hazards (> 36") with limited recovery area, non-gating system. Designers will designate hazard width on plan set.		
Name	Manufacturer	NCHRP Test Level
QuadGuard wide	Energy Absorption Systems	TL-2, TL-2+, TL-3
SCI100GM (TL-3) and SCI 70GM (TL-2)	Work Area Protection	TL-2, TL-3
TRACC (TL 3) and ShortTRACC (TL-2) wide systems	Trinity Highway Products, Inc.	TL-2, TL-3
Universal TAU II wide systems	Barrier Systems Inc.	TL-2, TL-2+, TL-3
Type B: Primarily to protect narrow fixed hazards (< 36") with limited recovery area, non gating system Designers will designate hazard width on plan set.		
Name	Manufacturer	NCHRP Test Level
QuadGuard	Energy Absorption Systems	TL-2, TL-2+, TL-3
Quest	Energy Absorption Systems	TL-3
SCI100GM (TL-3) and SCI 70GM (TL-2)	Work Area Protection	TL-2, TL-3
TRACC (TL 3) and ShortTRACC (TL-2)	Trinity Highway Products, Inc.	TL-2, TL-3
Universal TAU	Barrier Systems Inc.	TL-2, TL-2+, TL-3
Type C: Primarily to protect narrow hazards with available recovery area, gating system		
Name	Manufacturer	NCHRP Test Level
Brakemaster 350	Energy Absorption Systems	TL-3
CAT 350	Trinity Highway Products, Inc.	TL-3
FLEAT-MT	Road Systems Inc	TL-3
Type D: Primarily to protect hazards with limited recovery area and high potential of impact, non gating system These systems should be used in areas where more than one impact per year is anticipated or when repair history indicates two or more impacts over a three-year period. Designers will designate hazard width on plan set.		
Name	Manufacturer	NCHRP Test Level
Quad Guard Elite	Energy Absorption Systems	TL-2, TL-3
Quad Guard LMC	Energy Absorption Systems	TL-3
REACT 350	Roadway Safety Service Inc.	TL-2, TL-3
SCI100GM (TL-3) and SCI 70GM (TL-2)	Work Area Protection	TL-2, TL-3
Type E: Primarily to protect hazards a minimum of 15 feet from travel lane with available recovery area, gating system		
Name	Manufacturer	NCHRP Test Level
<u>Sand Barrels</u> Big Sandy Energite III Fitch Barrel	Traffix Devices Inc. Energy Absorption Systems Roadway Safety Services Inc.	TL-2, TL-3 Configure system to meet roadway design speed.

Summary Table of Approved Barrier End Treatments For Permanent Application

BARRIER & PARAPET END TREATMENTS		
Type F: Primarily to protect concrete barrier ends and bridge parapets with limited longitudinal space and available recovery area, gating system. See STD. DWG. CC Series		
Name	Manufacturer	NCHRP Test Level
BEAT-SSCC	Road Systems Inc	TL-3
Quad Trend 350	Energy Absorption Systems	TL-3
Type G: Primarily to protect guardrail approach ends on tangent guardrail installations with available recovery area, can be used to protect concrete barrier ends and bridge parapets when a transition element is used, gating system. See STD. DWG. CC Series		
Name	Manufacturer	NCHRP Test Level
ET PLUS (steel/wood posts)	Trinity Highway Products, Inc.	TL-3
SKT 350 (steel/wood posts)	Road Systems Inc.	TL-3
Type H: Primarily to protect guardrail approach ends on tangent or flared guardrail installations with available recovery area, can be used to protect concrete barrier ends and bridge parapet when a transition element is used, gating system. See STD. DWG. CC Series		
Name	Manufacturer	NCHRP Test Level
FLEAT 350 (steel/wood posts)	Road Systems Inc	TL-3
SRT/HBA 6-Post System (steel/wood posts)	Trinity Highway Products, Inc.	TL-3

The following are construction zone systems, to be supplied by the contractor in most cases. Not all the systems are NCHRP 350 approved but may be used until the service life has expired.

Construction Zone Crash Cushions		
Name	Manufacturer	NCHRP Test Level
ADIEM 350	Trinity Highway Products, Inc.	TL-3 any speed
ADIEM II	Trinity Highway Products, Inc.	TL-2, ≤ 45 MPH
NEAT®	Energy Absorption System	TL-2, ≤ 45 MPH This is a gating system and a recovery area behind the system of 75' x 20' is required. Recovery area will not have a slope of greater than 4:1.
QuadGuard CZ	Energy Absorption System	TL-2 ≤ 45 MPH 3 bay system TL-3 > 45 MPH 6 bay system
QUEST	Energy Absorption System	TL-3 > 45 MPH
REACT 350	Energy Absorption System	< 45 MPH 4 cylinders TL-2, ≥ 45 MPH ≤ 55 MPH 6 cylinders TL-3, > 55 MPH 9 cylinders
SCI 70 SCI 100	Work Area Protection	TL-2 ≤ 45 MPH TL-3 > 45 MPH
TAU-II	Barrier Systems Inc.	TL-2, ≤ 45 MPH 4 bay system TL-3 > 45 MPH 8 bay system
TRACC \ SHORTRACC	Trinity Highway Products, Inc.	TL-3 any speed TL-2, ≤ 45 MPH
Sand Barrels "Big Sandy" Energite III Universal Barrel	TrafFix Devices Inc. Energy Absorption Energy Absorption	TL-2, TL-3 When using this system all installation requirements as per a permanent application will be met. See Type E permanent crash cushion
GREAT CZ® This system is not an NCHRP 350 approved system. It may be used until service life has expired.	Energy Absorption System	Speed ≤ 45 MPH, 3 bays Speed > 45 MPH, 6 bays
WATER FILLED END TREATMENTS	Conditions for Use: <ol style="list-style-type: none"> 1. Use an environmentally friendly antifreeze solution when protection from freezing is required. 2. Pump fill liquid in and out of end treatment sections. 3. DO NOT DUMP ANY FILL LIQUID ONTO ROADWAY OR INTO THE RIGHT OF WAYS. 	
ABSORB 350	Barrier Systems Inc.	TL-2 ≤ 45 MPH, 5 element TL-3 > 45 MPH, 9 elements This is a gating system and a recovery area behind the system of 75' x 20' is required. Recovery area will not have a slope greater than 4:1.
Triton® CET System USE Triton Barrier sections with internal steel frames (white or orange in color)	Energy Absorption System	TL-2 ≤ 45 MPH, 6 std. sections TL-3 > 45 MPH, 6 std. sections set on specified pedestals. This is a gating system and a recovery area behind the system of 75' x 20' is required. Recovery area will not have a slope greater than 4:1.

TYPE A (4 approved systems)

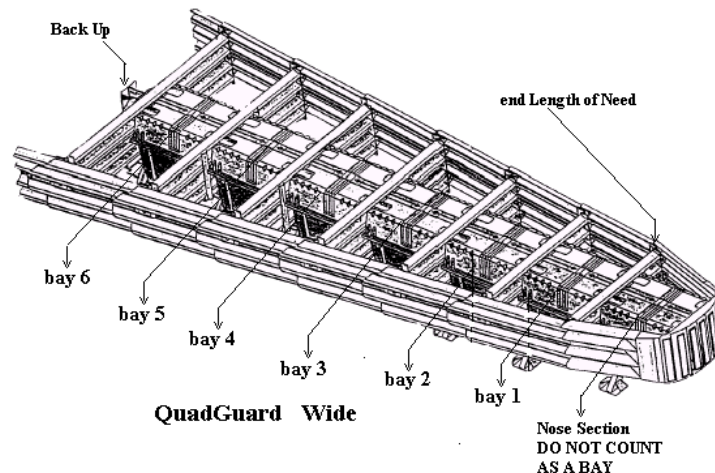
To protect fixed hazards greater than 36" inches wide, near the traveled lane(s), with less than 100 feet of longitudinal space in front of the hazard and a recover area behind the system is unattainable. Use to protect concrete barrier ends, bridge parapets or piers, and other hazards as a stand-alone system. A transition element is required to protect single or double-faced guardrail ends. These systems may be used on shoulders or in medians where a recovery area behind system and hazard is unattainable. These systems should be used in areas where minimal impacts are anticipated, one impact every three or more years.

Name: QuadGuard™ Wide, from Energy Absorption Systems

www.energyabsorption.com/products/permanent/quadguard_cen.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

Greg Robison, Sales Consultant, e-mail grobison@iwsafety.com



Length

Varies according to speed requirements, see NCHRP test level below

Width

2 standard widths: 69 inches and 90 inches, manufacturer will provide design for non-standard systems.

Site visit to existing hazard recommended to insure proper design is supplied.

Designers will designate hazard width on plan set.

NCHRP Test Level

TL-1, ≤ 40 mph	2 bay, length	11' 6"
TL-2, ≤ 45 mph	3 bay, length	14' 6"
TL-2+, 50 mph	4 bay, length	17' 6"
TL-2+, 55 mph	5 bay, length	20' 6"
TL-3, > 60 mph	6 bay, length	23' 6" <i>see note</i>

Length determined using Tension Strut Backup, will vary with other approved backup systems.

Note: *The manufacturer's design manual for this system list more bays for higher levels of speed. However these systems exceed the requirements set by FHWA and are not required for use.*

Designers will not specify higher speed systems for installation.

Suppliers will bid only systems to the capacity as designated in these Guidelines.

Length of Need

From rear of nose section

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

System is equipped with two types of crushable, energy absorbing cartridges that absorb energy from an impacting vehicle. The fender panels redirect an impacting vehicle.

This system may be retrofitted to meet the requirements of the Type D, QuadGuard Elite System requirements, when repair history indicates a benefit would be realized.

Application

For fixed objects near the traveled lane(s), with a width ranging from 60 inches to a maximum width of 90 inches, where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, and as a stand-alone system.

This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles, refer to UDOT STD DWG CC 4. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

This system uses two types of crushable, energy absorbing cartridges. It is critical the proper cartridge is in the proper bay. The nose compartment uses a Type I cartridge in all applications. See manufacturer's specifications for pad, backup and transition requirements.

The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed.

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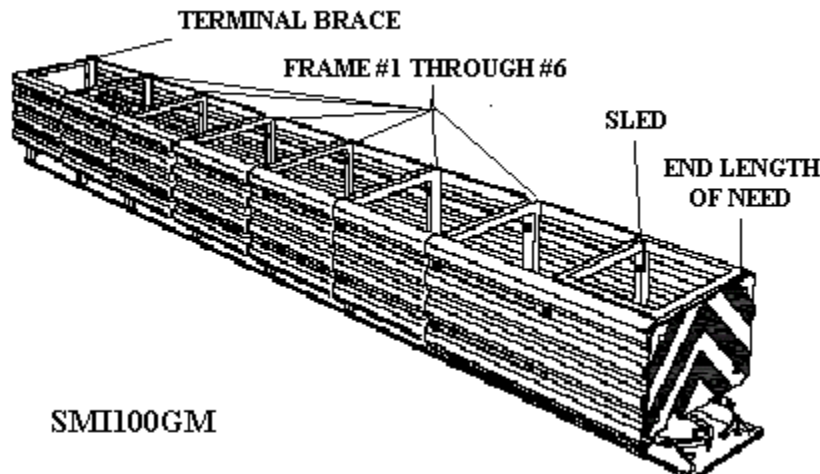
Type A (continued)

Name: Smart Cushions Innovations (SCI), from Work Area Protection Corporation

<http://www.workareaprotection.com/>

Local supplier: SCI Products Inc., St. Charles, IL phone: 801-330-4324, or 800-327-4417

Roger Alfrey, Rocky Mountain Territory Manager, ralfrey@sciproductsinc.com



Length

Two standard lengths, see NCHRP Test Level

Length can vary based on width requirements, contact local supplier for design detail requirements.

Width

Custom designed, width of hazard required for proper design.

Site visit to existing hazard recommended to insure proper design is supplied.

Designers will designate hazard width on plan set.

NCHRP Test Level

TL-2 ≤ 45 MPH SCI 70, length 13' 6"

TL-3 > 45 MPH SCI 100, standard length 21' 6".

Length will increase with width. Consult supplier for design requirements.

Length of Need

From the front of system

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

System uses the combination of a cable braking action and the compression of a shock-absorbing cylinder. The fender panels redirect an impacting vehicle.

Application

For fixed objects near the traveled lane(s), where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, as a stand-alone system. Transition elements are required for use with single and double-faced guardrail and when placed where there is a

potential for a backside impact. This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles Refer to UDOT STD DWG CC series. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

See manufacturer's specifications for pad, backup and transition requirements. The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1. The object marker plate and marker post will not be a separate pay item and will be installed in all application.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed

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Type A (continued)

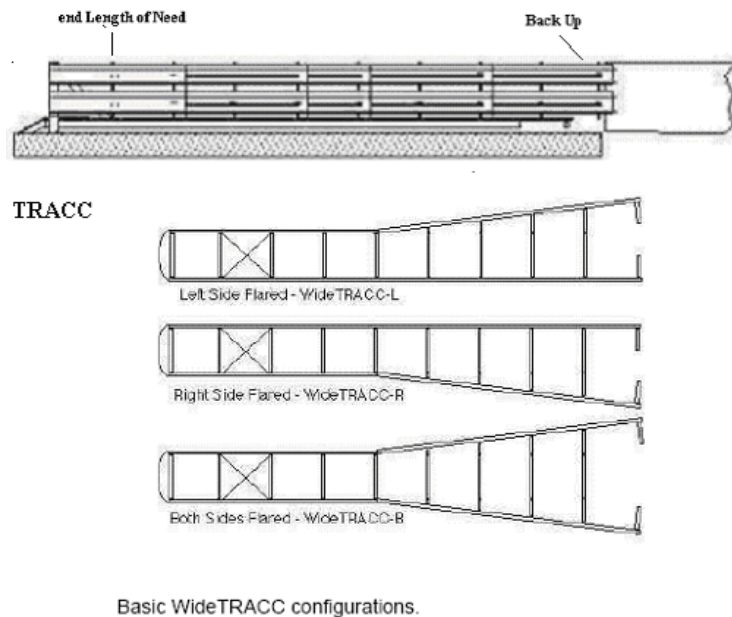
Name: Wide TRACC™ system, from Trinity Highway Products, Inc.

www.highwayguardrail.com

(Supplier will supply Modular TRACC 2005 system)

Local supplier: Trinity Highway Products, Centerville, Utah phone: (801) 292-4461

Sales Consultant : Ralph Evans, email ralph.evans@trin.net



Length

Two standard lengths, see NCHRP Test Level

Length can vary based on width requirements, contact local supplier for design detail requirements.

Width

Custom designed, width of hazard required for proper design. When design of system consists of a right or left flare, the design will be such as to place the TRACC as far from the closest approach lane.

Site visit, to existing hazard recommended, to insure the proper design is supplied.

Designers will designate hazard width on plan set.

NCHRP Test Level

TL-2, ≤ 45 mph ShorTRACC, 14 feet, plus the length of the wing extension to obtain the required width.

TL-3, > 45 mph TRACC, 21 feet, plus the length of the wing extension to obtain the required width.

Note: The manufacturer of this system has a design that exceed TL-3, this system exceed the requirements set by FHWA and is not required for use.

Designers will not specify higher speed systems for installation.

Suppliers will bid only systems to the capacity as designated in these Guidelines.

Length of Need

From second frame element from front of system

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

System uses cutter bolts, at the base of the system, to shear steel plates, which absorbs energy from an impacting vehicle. The fender panels redirect an impacting vehicle

Application

For fixed objects near the traveled lane(s), with a width ranging from 37 inches to required width of hazard, and where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, as a stand-alone system. Transition elements are required for use with single and double-faced guardrail and when placed where there is a potential for a backside impact. This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles Refer to UDOT STD DWG CC 4. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

See manufacturer's specifications for pad, backup and transition requirements. This system uses rip plates of varying gage, it is critical the proper rip plate is installed in the correct position. The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all application.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed

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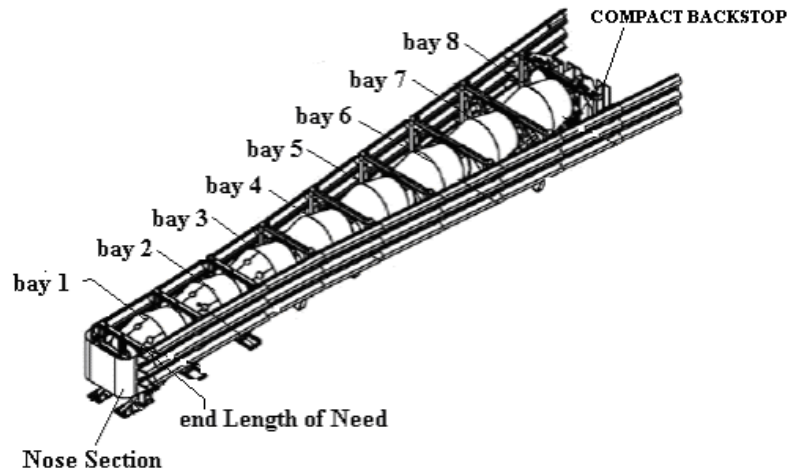
Type A (continued)

Name: Wide Universal TAU II® system, from Barrier System, Inc.

<http://www.barriersystemsinc.com/>

Local supplier: Safety Supply & Sign Co. Inc. Salt Lake City, Utah phone: (801) 973-2266

Sales Consultant: Kelly Matkin e-mail kelly@safetysupplyandsign.com



UNIVERSAL TAU II Wide
TL-3 System shown

Length

Length can vary based on width requirements, contact local supplier for design detail requirements.

Width

Systems are available in width of 42 inches to 102 inches in 6-inch increments.

Site visit to existing hazard recommended to insure proper design is supplied.

Designers will designate hazard width on plan set.

NCHRP Test Level

TL-1, ≤ 40 mph	2 to 3 bay, based on width requirement
TL-2, ≤ 45 mph	3 to 5 bay, based on width requirement
TL-2+, 50 mph	4 to 5 bay, based on width requirement
TL-2+, 55 mph	5 to 7 bay, based on width requirement
TL-3, > 60 mph	7 to 8 bay, based on width requirement <i>see note</i>

Note: *The manufacturer's design manual for this system list more bays for higher levels of speed. However these systems exceed the requirements set by FHWA and are not required for use.*

Designers will not specify higher speed systems for installation.

Suppliers will bid only systems to the capacity as designated in these Guidelines.

Length of Need

From the beginning of system

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

System is equipped with two types of crushable, energy absorbing cartridges that absorb energy from an impacting vehicle. The fender panels redirect an impacting vehicle.

Application

For fixed objects near the traveled lane(s), with a width ranging from 37 inches to required width of hazard, and where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, as a stand-alone system.

This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles, refer to UDOT STD DWG CC 4. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

There are specific backstop requirements for this system, consult manufacturer's requirements to insure proper backup is installed for the required application.

This system uses two types of crushable, energy absorbing cartridges. It is critical the proper cartridge is in the proper bay. The 1st bay can use either Type A or Type B cartridge and is based on the design application. It is critical that the right cartridge is placed in the appropriate location.

The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all application.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed.

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Type B (5 approved system)

To protect fixed hazards 36 inches wide or less and near the traveled lane(s), with less than 100 feet of longitudinal space in front of the hazard and a recovery area on the backside of the system is unattainable. Use to protect concrete barrier ends, bridge parapets or piers, and other hazards as a stand-alone system. A transition element is required to protect single or double-faced guardrail ends. These systems may be used on shoulders or in medians when adequate recovery area is unattainable. These systems should be used in areas where minimal impacts are anticipated (one impact every three or more years).

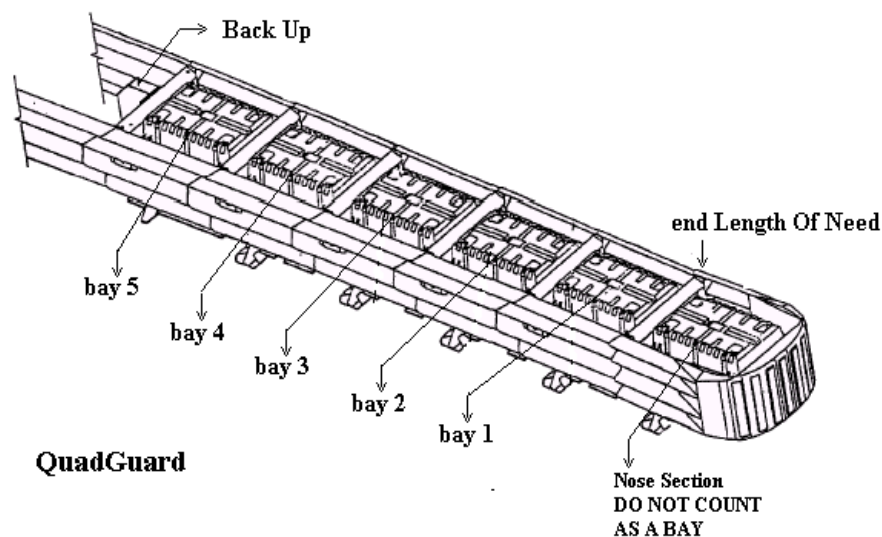
Name: QuadGuard™ from, Energy Absorption Systems

www.energyabsorption.com/products/permanent/quadguard_cen.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

<http://www.interwestsafety.com/store/categoryView.aspx?idCategory=7>

Greg Robison, Sales Consultant, e-mail grobison@iwsafety.com



Length: Varies according to speed requirements, see test level below.

Width:

Three standard widths: 24 inches, 30 inches and 36 inches

NCHRP Test Level

TL-1, ≤ 40 mph	2 bay, length 8' 9"
TL-2, ≤ 45 mph	3 bay, length 11' 9"
TL-2+, 50 mph	4 bay, length 14' 9"
TL-2+, 55 mph	5 bay, length 17' 9"
TL-3, > 60 mph	6 bay, length 20' 9" <i>see note</i>

Length determined using Tension Strut Backup, will vary with other approved backup systems.

Note: *The manufacturer's design manual for this system lists more bays for higher levels of speed. However these systems exceed the requirements set by FHWA and are not required for use.*

Designers will not specify higher speed systems for installation.

Suppliers will bid only systems to the capacity as designated in these Guidelines.

Length of Need:

Rear of the nose section

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

System is equipped with two types of crushable, energy absorbing cartridges that absorb energy from an impacting vehicle. The fender panels redirect an impacting vehicle.

This system may be retrofitted to meet the requirements of the Type D, QuadGuard Elite System requirements, when repair history indicates a benefit would be realized.

Application

For fixed objects near the traveled lane(s), with a width ranging from 24 inches to a maximum width of 36 inches, where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, and as a stand-alone system.

This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles, refer to UDOT STD DWG CC 4. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

This system uses two types of crushable, energy absorbing cartridges. It is critical the proper cartridge is in the proper bay. The nose compartment uses a Type I cartridge in all applications. See manufacturer's specifications for pad, backup and transition requirements.

The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all application.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed.

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Type B (continued)

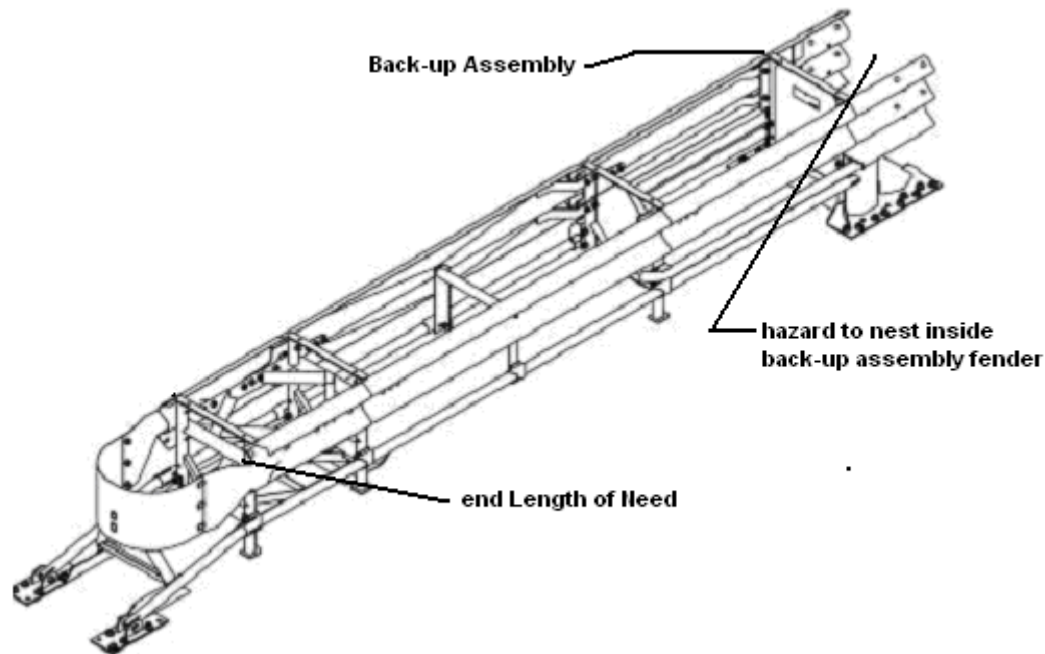
Name: QUEST™, from Energy Absorption Systems, Inc.

http://www.energyabsorption.com/products/permanent/quest_crash_cushions.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

<http://www.interwestsafety.com/store/categoryView.aspx?idCategory=7>

Greg Robison, Sales Consultant, e-mail grobison@iwsafety.com



Length

Standard: 22'2"

Width

Standard: 24"

NCHRP Test Level

TL-3, may be used at any speed limit

Length of Need

From front of system

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

During head-on impacts, the system telescopes rearward and energy is absorbed through momentum transfer, friction and deformation. When impacted from the side, the system restrains lateral movement by dynamic tension developed between end restraints and safely redirects the impacting vehicle.

Application

For fixed objects near the traveled lane(s), with a hazard width of 24 inches or less, and where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, as a stand-alone system. System is designed to have the hazard nested inside back-up fender panels. Transition elements are required for use with single and double-faced guardrail and when placed where there is a potential for a backside impact. This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles Refer to UDOT STD DWG CC 4. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

See manufacturer's specifications for pad, backup and transition requirements. The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all application.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed

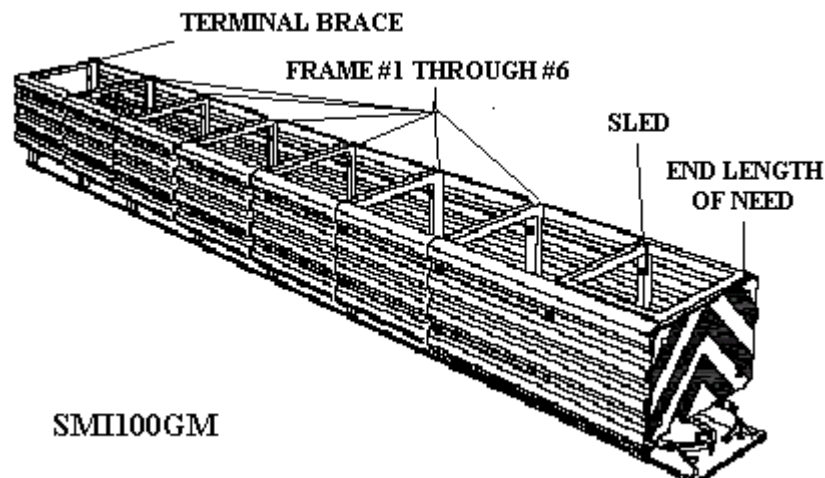
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Type B (continued)

Name: Smart Cushions Innovations, from Work Area Protection Corporation

<http://www.workareaprotection.com/>

Local supplier: Local supplier: SCI Products Inc., St. Charles, IL phone: 801-330-4324, or 800-327-4417 Roger Alfrey, Rocky Mountain Territory Manager, ralfrey@sciproductsinc.com



Length

Two standard lengths, see NCHRP Test Level

Length can vary based on width requirements, Contact local supplier for design detail requirements.

Width

Standard width 24"

Additional width is developed using transition panels. Standard transition panel for 30" and 36" available.

NCHRP Test Level

TL-2 ≤ 45 MPH SCI 70, length 13' 6"

TL-3 > 45 MPH SCI 100, standard length 21' 6".

Length of Need

From the front of system

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

System uses the combination of a cable braking action and the compression of a shock-absorbing cylinder. The fender panels redirect an impacting vehicle.

Application

For fixed objects near the traveled lane(s), with a width ranging up to 30 inches, and where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, as a stand-alone system. Transition elements are required for use with single and double-faced guardrail and when placed where there is a potential for a backside impact. This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles Refer to UDOT STD DWG CC series. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

See manufacturer's specifications for pad, backup and transition requirements. The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1. The object marker plate and marker post will not be a separate pay item and will be installed in all application.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed

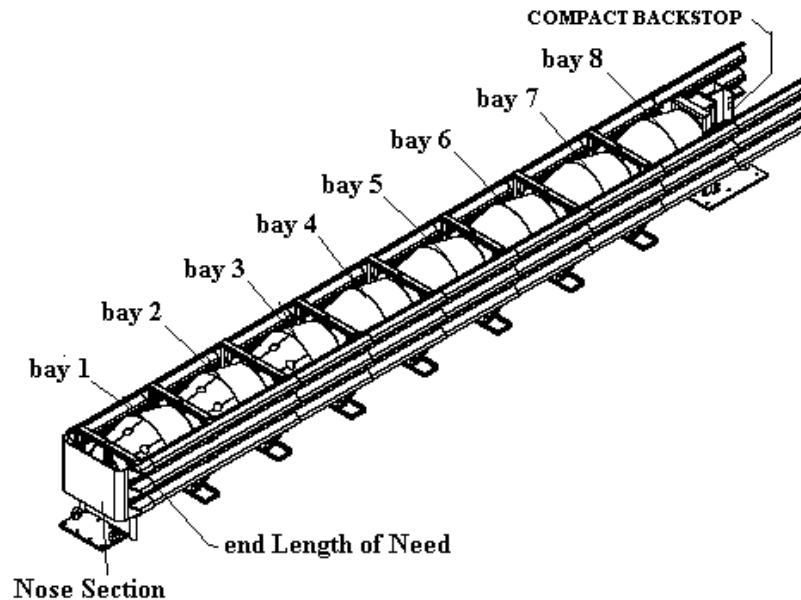
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Type B (continued)

Name: Universal TAU II® from Barrier Systems, Inc. <http://www.barriersystemsinc.com/>

Local supplier: Safety Supply & Sign Co. Inc. Salt Lake City, Utah phone: (801) 973-2266

Sales Consultant: Kelly Matkin e-mail kelly@safetysupplyandsign.com



UNIVERSAL TAU II
TL-3 SYSTEM shown

Length

Length varies based on speed width requirements of the application. Contact local supplier for design detail requirements.

Width

Systems are available in width of 24, 30 and 36 inches.

NCHRP Test Level

TL-1, ≤ 40 MPH	3 bay
TL-2, 45 MPH	4 bay system
TL-2+, 50 MPH	4 bay systems based on width requirement
TL-2+, 55 MPH	7 bay systems based on width requirement
TL-3, ≥ 60 MPH	8 bay systems based on width requirement <i>see note</i>

Note: *The manufacturer's design manual for this system list more bays for higher levels of speed. However these systems exceed the requirements set by FHWA and are not required for use.*

Designers will not specify higher speed systems for installation.

Suppliers will bid only systems to the capacity as designated in these Guidelines.

Length of Need

From the beginning of system

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

System is equipped with two types of crushable, energy absorbing cartridges that absorb energy from an impacting vehicle. The fender panels redirect an impacting vehicle.

Application

For fixed objects near the traveled lane(s), with a hazard width of 36 inches or less, and where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, as a stand-alone system.

This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles, refer to UDOT STD DWG CC 4. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

There are specific backstop requirements for this system, consult manufacturer's requirements to insure proper backup is installed for the required application.

This system uses two types of crushable, energy absorbing cartridges. It is critical the proper cartridge is in the proper bay. The 1st bay uses Type A cartridge in all application except for speeds 30 MPH and lower. It is critical that the right cartridge is placed in the appropriate location.

The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all application.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed.

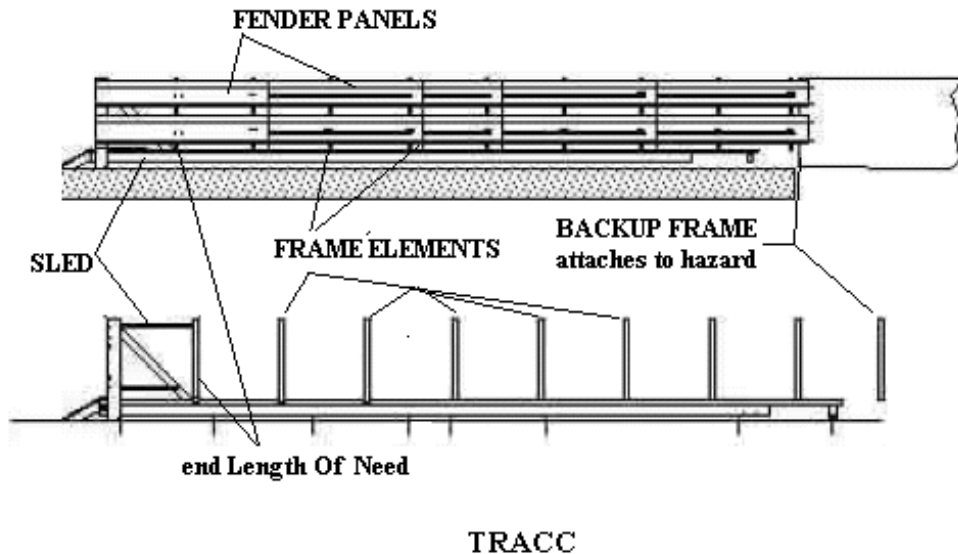
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Type B (continued)

Name: TRACC™ system, from Trinity Highway Products, Inc. www.highwayguardrail.com
(Supplier will supply Modular TRACC 2005 system)

Local supplier: Trinity Highway Products, Centerville, Utah phone: (801) 292-4461

Sales Consultant : Ralph Evans, email ralph.evans@trin.net



Length

2 standard lengths 14' and 21'. See NCHRP test level below

Width

2 standard width, 24 and 30 inches

NCHRP Test Level

TL-2, ≤ 45 MPH 14' designated as ShortTRACC

TL-3, > 45 MPH 21' designated as TRACC, 14 feet, use with speeds of 45 MPH or less

Note: *The manufacturer's design manuals for this system list a longer system for higher levels of speed. However this system exceed the requirements set by FHWA and are not required for use.*

Designers will not specify higher speed systems for installation.

Suppliers will bid only systems to the capacity as designated in these Guidelines.

Length of Need

From second frame element from front of system

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing.

System uses cutter bolts, at the base of the system, to shear steel plates, which absorbs energy from an impacting vehicle. The fender panels redirect an impacting vehicle

Application

For fixed objects near the traveled lane(s), with a hazard width of 30 inches or less required, and where there is less than 100 feet of clear area in front of hazard, and the recovery area on the backside of the system is less than 75 feet x 20 feet.

This system can be used to protect concrete barrier, hazards in gore areas, lighting and sign structures, bridge parapets, piers, as a stand-alone system. Transition elements are required for use with single and double-faced guardrail and when placed where there is a potential for a backside impact. This system should be used in areas where minimal impacts are anticipated (one impact every three or more years).

Requirements

The area in front of the system will have a slope of 10:1 or less and be free of any obstacles for a minimum of 50 feet. The slope to the sides of the system, from any travel lane, will be no greater than 10:1 and be free of any obstacles Refer to UDOT STD DWG CC 4. When system is installed in a bi-directional application a transition will be installed to accommodate a backside impact as per Standard Specification 02843. Transition elements are required for use with single and double-faced guardrail.

See manufacturer's specifications for pad, backup and transition requirements. This system uses rip plates of varying gage, it is critical the proper rip plate is installed in the correct position. The manufacturer, supplier, or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all application.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed.

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Type C (3 approved systems)

To protect fixed objects 24 inches wide or less, within 15 feet of traveled way, and with longitudinal space in front of the hazard greater than 100 feet. Primarily used with double-faced guardrail. A transition element is required for concrete barrier or bridge parapet. These systems may be used on shoulders or in medians. Shoulder application requires a recovery area of 75 feet x 20 feet. Median application is required to have a recovery area of no less than 75 feet x 20 feet on both sides of the system. These systems should be used in area where minimal impacts are anticipated (one impact every three or more years).

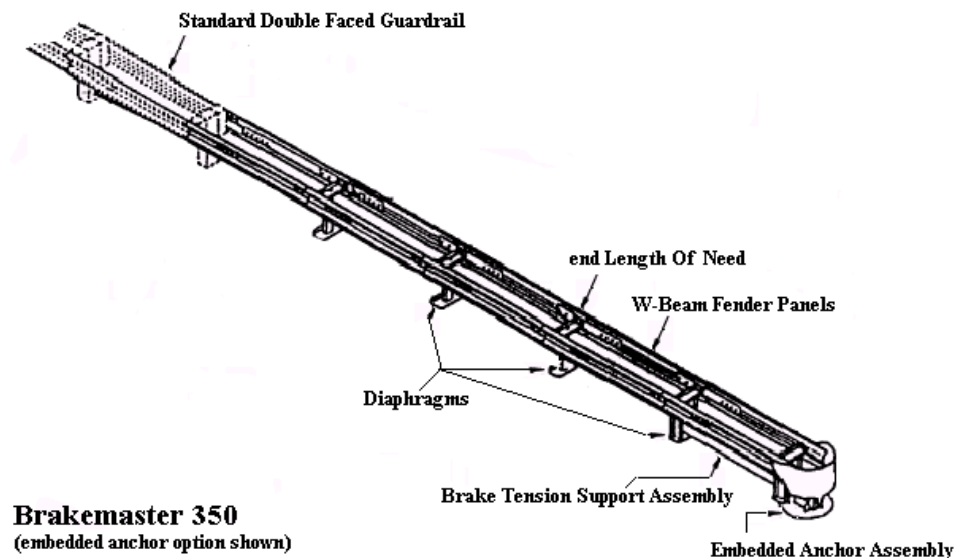
Name: BRAKEMASTER® 350, from Energy Absorption Systems

http://www.energyabsorption.com/products/permanent/permanent_roadway_safety.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

<http://www.interwestsafety.com/store/categoryView.aspx?idCategory=7>

Greg Robison, Sales Consultant, e-mail grobison@iwsafety.com



Length: 31 feet 6 inches

Width: 2 feet 1 inch

Front Anchor Option:

This system is available with an embedded concrete anchor assembly, or a two-foundation tube anchor assembly. Both anchor assemblies are acceptable.

NCHRP Test Level: TL-3, may be used at any speed limit

Length of Need: Starting at diaphragm # 3, 16 feet from front of system

Characteristics:

Gating, re-directive, bi-directional, uni-directional. This system rides above the ground and has no post. When this system is impacted head-on the braking system engages controlling the deceleration of the impacting vehicle to dissipate the energy of the impacting vehicle. This system has many parts that can be reused after impact; inspection should be completed prior to ordering replacement parts.

Application:

Shoulder: For fixed objects within 15 feet of the traveled lane and a width 24 inches or less, and where there is a minimum of 100 feet of clear area in front of hazard (125 feet when a transition element required to attach system to bridge parapet or concrete barrier).

Median: Refer to UDOT STD DWG CC 5A for specific recovery area requirements and grading requirements. May be installed on concrete, asphalt, or compacted untreated base surfaces.

Requirements:

Transition requirements change for concrete barrier and bridge parapet, see manufacturer's specifications for proper transition element. The system attaches directly to double-faced guardrail, with a minimum of 25' tangent barrier, refer to UDOT STD DWG CC 5A. Refer to manufacturer's installation instructions for front anchor assembly requirements. The approach to the front of the system requires a slope of no greater than 10:1 for a length of 50 feet, and is free of any obstacles. The approach slope from the travel lane(s) to the side(s) of the system is required be no greater than 10:1 and be free of any obstacles. The recovery area behind the system will not be less than 75 feet x 20 feet, and on a slope no greater than 4:1, refer to UDOT STD DWG CC series.

The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD DWG CC 1.

The object marker plate and marker post will not be a separate pay item and must be installed in all applications.

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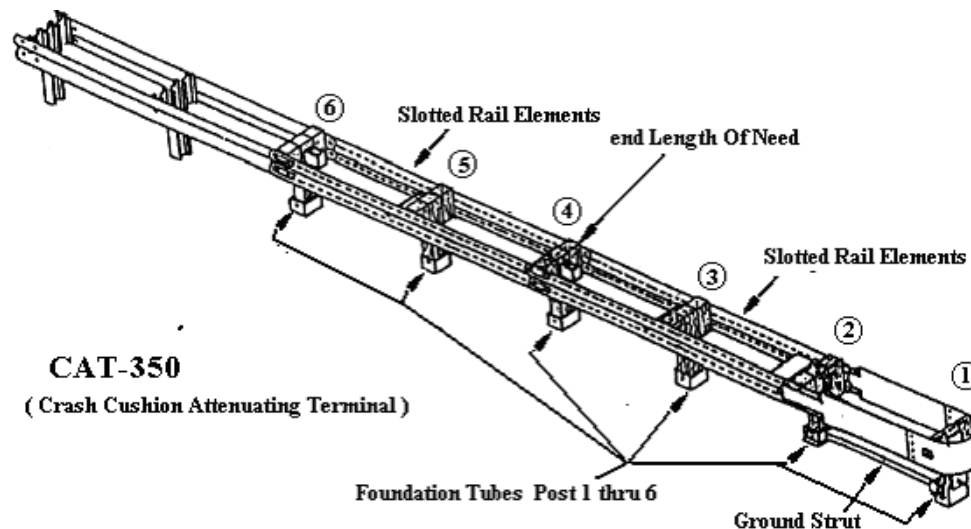
Type C (continued)

Name: C.A.T. 350™ from, Trinity Highway Products, Inc. www.highwayguardrail.com

Local supplier: Trinity Highway Products, Centerville, Utah

phone: (801) 292-4461

Sales Consultant : Ralph Evans, email ralph.evans@trin.net



Length: 31 feet 3 inches

Width: 2 feet

NCHRP Test Level: TL-3, may be used at any speed limit

Length of Need: Starting at post # 4, 18 feet 9 inches from front of system

Post Option:

Posts 1 - 6: 6' foundation tube with shortened breakaway posts; post 1 is a special ½ post for this system.

Characteristics

Gating, re-directive, bi-directional, and unidirectional. When this system is impacted head-on the slotted guardrail is forced over bolts, which shear the rail. This shearing dissipates the energy of the impact, along with the shortened wood breakaway posts. Soil tubes required. This is a sacrificial system; many of the components must be replaced after an impact.

Applications

Shoulder: For fixed objects within 15 feet of the traveled lane and a width 24 inches or less and where there is a minimum of 100 feet of clear area in front of hazard (150 feet when a transition element is required to attach system to bridge parapet or concrete barrier). The approach to the front of the system requires a slope of no greater than 10:1 for a length of 50 feet, and free of any obstacles. The approach slope from the travel lane to the side of the system is required be no greater than 10:1 and be free of any obstacles. The recovery area behind the system will not be less than 75 feet x 20 feet, and on a slope no greater than 4:1.

Median: Refer to UDOT STD DWG CC 5B for specific recovery area requirements and grading requirements. May be installed on compacted untreated base surfaces.

Requirements

Transition requirements are different for concrete barrier and w-beam barrier attachments. See UDOT Standard Drawings CC and BA series for requirements. The system attaches directly to single and double-faced guardrail. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all applications.

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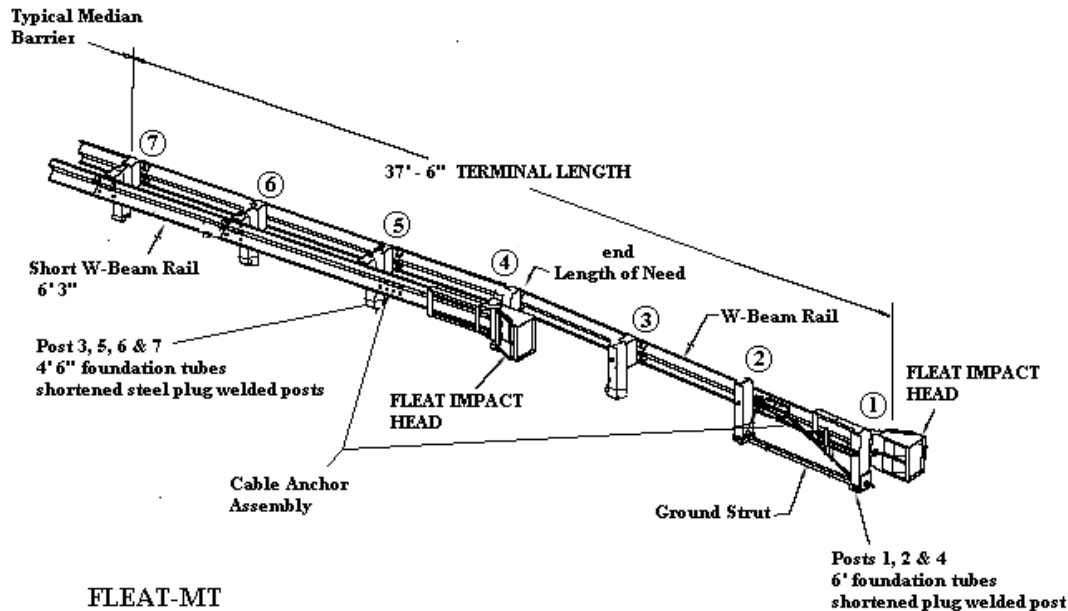
Type C (continued)

Name: FLEAT-MT from Road Systems Inc., www.roadsystems.com ,

Local supplier: Universal Industrial Sales, Pleasant Grove, Utah phone: (801) 785-0505

<http://www.universalindustrialsales.com/>

Molly Weight, Sales Consultant, e-mail molly@uismail.com



37 feet 6 inches

Length:

Width:

14 inches @ lead impact head, 41 inches @ trailing impact head

NCHRP Test Level:

TL-3, may be used at any speed limit

Length of Need:

Starting at post # 4, 18 feet 9 inches from front of system

Post Option:

Posts 1, 2, & 4: 6' foundation tube with shortened steel plug welded post.

Posts 3, 5, 6, & 7: 4' 6" foundation tube with shortened steel plug welded posts

Characteristics

Re-directive, unidirectional, gating. The impact heads slides over the slotted rail elements, the head kinks the rail element, absorbing the energy from the impacting vehicle, and the rail is then pushed out the front side of the heads. The cable anchor assemblies are attached to the first rail element after each of the impact heads using shoulder bolts.

Characteristics

Gating, re-directive, bi-directional, and unidirectional. When this system is impacted head-on the vehicle engages the first impact head and if sufficient energy is not dissipate the second impact head will engage to bring vehicle to a stop.

Applications

Median: Refer to UDOT STD DWG CC 5C for specific recovery area requirements and grading requirements. May be installed on compacted untreated base surfaces.

Requirements

Transition required for concrete barrier and bridge parapet. The system attaches directly to double-faced guardrail. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel, one for each impact head, and marker posts, UDOT STD DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all applications.

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Type D (3 approved systems)

To protect fixed hazards near the traveled lane(s), with less than 100 feet of space in front of the hazard. Used to protect concrete barrier ends, bridge parapets or piers, or other hazards as a stand-alone system. A transition element is required for use with single and double face guardrail. These systems may be used on shoulders or in medians.

These systems should be used in areas where more than one impact per year is anticipated or when repair history indicates two or more impacts over a three-year period.

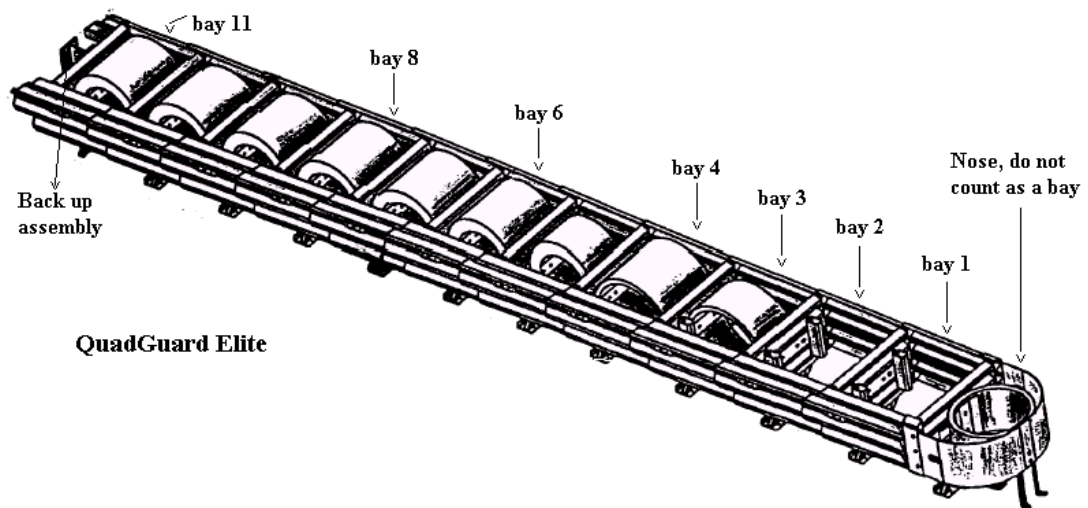
Name: QuadGuard® ELITE, from Energy Absorption Systems

www.energyabsorption.com/products/permanent/QuadGuardEliteSystem.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

<http://www.interwestsafety.com/store/categoryView.aspx?idCategory=7>

Greg Robison, Sales Consultant, e-mail grobison@iwsafety.com



Length: Varies with speed requirements, see test level below

Width:

Five standard widths: 24 inches, 30 inches, 36 inches, 60 inches, and 90 inches. The 60 inch and 90 inch systems flare out on both sides to obtain the required width at backup.

Designers will designate hazard width on plan set.

NCHRP Test Level

TL-2, ≤ 45 mph	7 bays, length 21 feet 6 inches
TL-3, > 45 mph	11 bays, length 33 feet 4 inches

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing. This system uses polyethylene cylinders, of varying wall thickness, which compress upon impact absorbing the energy from the impacting vehicle. The cylinders will return to their original shape after system is reset. Bays 1 and 2 do not have cylinders. The fender panels redirect an impacting vehicle. This system can withstand multiple impacts with minimal repair.

Application

To protect fixed objects near the traveled lane(s), with width up to 90 inches. The approach to the front of the system will have a slope of 1:10 or less and be clear of any obstructions for a minimum of 50 feet. The approach slopes on either side of the system will be 1:10 or less. Refer to UDOT STD DWG CC 4.

This system should be used in areas where at least one impact per year is anticipated, or when repair history indicates two or more impacts over a three-year period.

Requirements

See manufacturer's specifications for pad, backup and transition requirements. See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all application.

Note: The QuadGuard Elite and QuadGuard LMC are similar in appearance; the difference is the material the cylinders are manufactured with.

The cylinders from the QuadGuard Elite may be used to upgrade the standard QuadGuard systems (Types A and B) when required.

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Type D (continued)

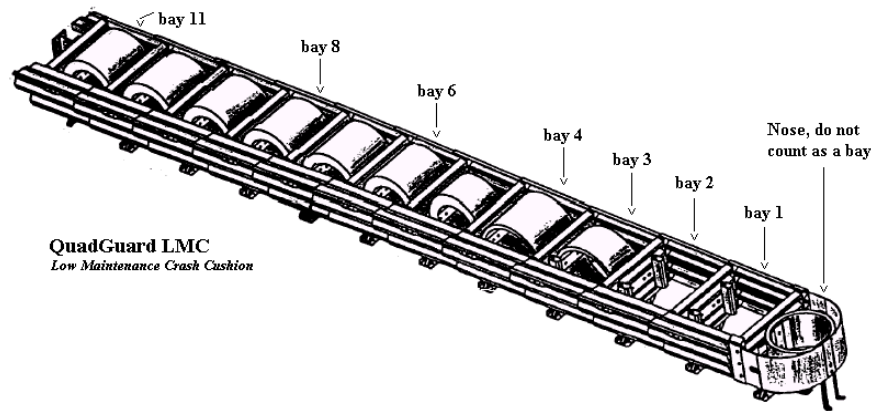
Name: QuadGuard® LMC from Energy Absorption Systems

www.energyabsorption.com/products/permanent/QuadGuardLMCSystem.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

<http://www.interwestsafety.com/store/categoryView.aspx?idCategory=7>

Greg Robison, Sales Consultant, e-mail grobison@iwsafety.com



Length: 31 feet, this system is available in one length only

Width:

Three standard widths: 36 inches, 60 inches, and 90". The 60 inch and 90 inch systems flare out on both sides to obtain the required width at backup.

Designers will designate hazard width on plan set.

NCHRP Test Level: TL-3, 11 bays (may be used with any speed)

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing. This system uses elastomeric cylinders, of varying wall thickness, which compress upon impact absorbing the energy from the impacting vehicle. The cylinders will return to their original shape after system is reset. Bays 1 and 2 do not have cylinders. The fender panels redirect an impacting vehicle. This system can withstand multiple impacts with minimal repair.

Application

To protect fixed objects near the traveled lane(s), with widths up to 90 inches. This system should be used in areas where at least one impact per year is anticipated, or when repair history indicates two or more impacts over a three-year period.

Requirements

See manufacturer's specifications for pad, backup and transition requirements. The approach to the front of the system will have a slope of 10:1 or less and be clear of any obstructions. The approach slopes on either side of the system will be 10:1 or less. Refer to UDOT STD DWG CC 4.

See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all application.

* Note: The QuadGuard LMC and QuadGuard Elite are similar in appearance, the difference is the material the cylinders are manufactured with.

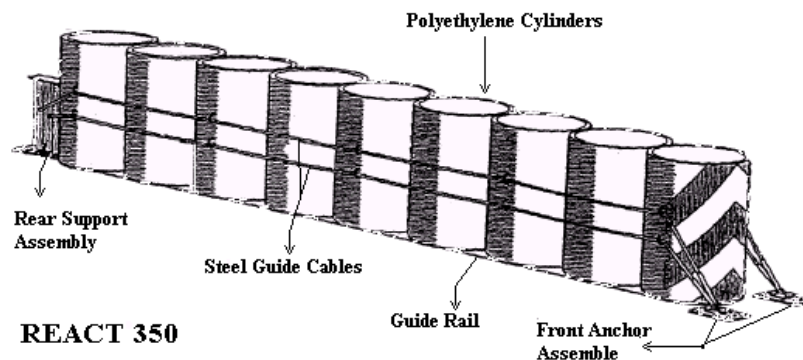
Type D (continued)

Name: REACT 350TM from Energy Absorption Systems,
www.energyabsorption.com/products/permanent/React350.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

<http://www.interwestsafety.com/store/categoryView.aspx?idCategory=7>

Greg Robison, Sales Consultant, e-mail grobison@iwsafety.com



Length: Varies to speed requirements, see test level below

Width: single row 3 feet 11 inches, multiple row can be added to achieve desired width.

Designers will designate hazard width on plan set.

NCHRP Test Level

TL-2, ≤ 45 mph	varies based on hazard width
TL-2+, 50 mph	varies based on hazard width
TL-2+, 55 mph	varies based on hazard width
TL-3, ≥ 60 mph	varies based on hazard width

Characteristics

Re-directive, bi-directional, unidirectional, non-gating, non-pocketing. This system uses polyethylene cylinders with varying wall thickness, which compress upon impact absorbing the energy from the impacting vehicle. The cylinders will return to approximately 80% of their original shape after impact. The cables used on this system give the system a re-directive capability. This system can withstand multiple impacts with minimal repair.

Application

To protect fixed objects within 15 feet of the traveled lane, with width up to 36 inches. This system should be used in areas where at least one impact per year is anticipated, or when repair history indicates two or more impacts over a three-year period.

Requirements

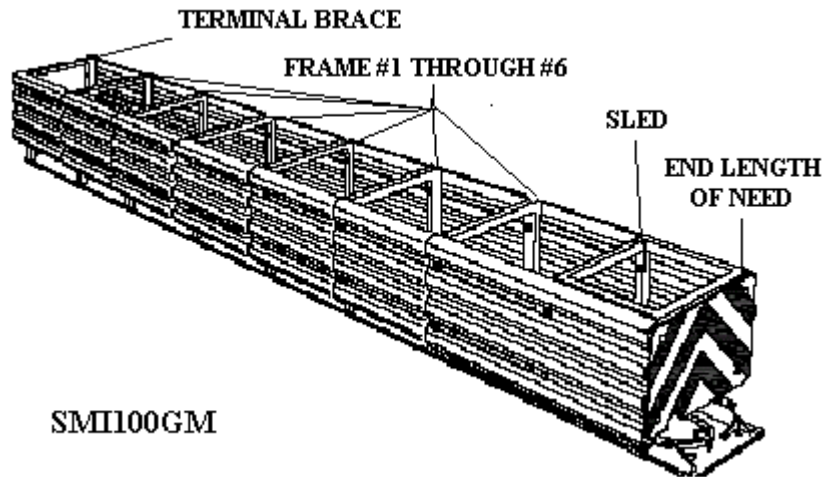
See manufacturer's specifications for pad, backup and transition requirements. . The approach to the front of the system will have a slope of 1:10 or less and be clear of any obstructions. The approach slopes on either side of the system will be 1:10 or less. Refer to UDOT STD DWG CC 4. See STD DWG CC 2, Plan A2 or STD DWG CC 3 Guideline B, where drainage requirements are needed. The manufacturer provides the object marker for this system and a marker post is not required due to the height of the system.

Type D (continued)

Name: Smart Cushions Innovations, from Work Area Protection Corporation

<http://www.workareaprotection.com/>

Local supplier: Local supplier: SCI Products Inc., St. Charles, IL phone:801-330-4324, or 800-327-4417 Roger Alfrey, Rocky Mountain Territory Manager, ralfrey@sciproductsinc.com



This system is approved for use as a Type A, Type B and /or Type D system.

Use and approval as a Type D system is based on Department's evaluation of repair records as submitted to FHWA in an in-service evaluation report. Although this system is not self restoring the repair cost are comparable to systems in this category.

See Type A or Type B systems for use and installation requirements.

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Type E- Sand Barrel Arrays

To protect fixed hazards outside 15 feet of the traveled way where there is an unlimited amount of space. This system can be configured to meet varying width requirements. Use to protect concrete barrier ends, bridge parapets or piers, or other hazards as a stand-alone system. This system can be used in a work zone when the hazard being protected meets the 15-foot criteria.

Name: Three approved manufacturers.

1. “Big Sandy” Traffix Devices Inc.

www.traffixdevices.com

Local supplier: Safety Supply & Sign Co. Salt Lake City, Utah phone: (801) 973-2266

2. Energite® III Barrels, Energy Absorption Systems

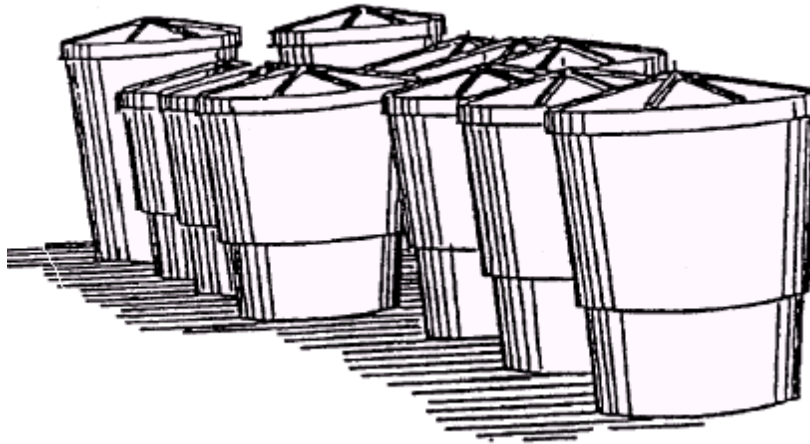
www.energyabsorption.com/products/permanent/EnergiteIIISystem.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

3. Universal Barrels, Energy Absorption Systems

www.energyabsorption.com/products/permanent/UniversalBarrels.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321



Sand Barrels

Length: Variable

Width: Variable

Designers will designate hazard width on plan set.

NCHRP Test Level: TL-1, TL-2, TL-3

Design system to meet roadway design speed.

Length of Need: Variable

Use Energite III Design Manual when designing this system.

Available from Division of Traffic & Safety

Characteristics

Non-re-directive, uni-directional, bi-directional, gating, pocketing. This system uses plastic container filled with varying amounts of sand, which transfers and dissipates the energy from an impacting vehicle.

Application

Use to protect fixed objects outside 15 feet of the traveled lane.

Requirements

Refer to UDOT STD DWG CC 6 for pad and placement requirements. The approach slope to the front of the system will be no greater 20:1 and free any obstacles for a length of 50 feet prior to the first barrel.

Median Installation

The approach slope to the front, sides, and back of the installation, from any travel lanes will be no greater than 10:1 and be free of any obstacles.

Shoulder Installation

The approach slope to the front, sides, of the installation, from the approach travel lanes will be no greater than 10:1 and be free of any obstacles. The required recovery area behind the system is 75 feet X 20 feet, and on a slope no greater than 4:1.

Use Energite III Design Manual when designing this system (available from Division of Traffic & Safety). The manufacturer, supplier or installer of the system will provide the appropriate directional object panel UDOT STD DWG CC 1. The object marker plate will not be a separate pay item and must be installed in all application.

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Type F (2 approved system)

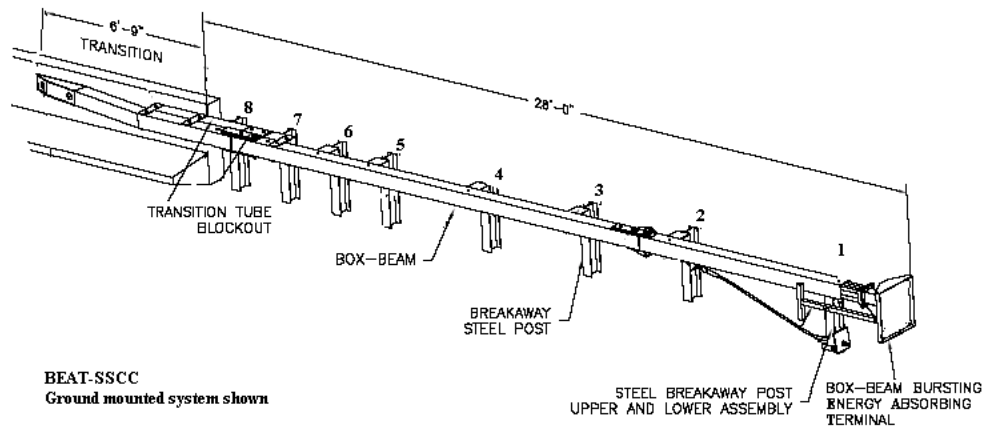
Use to protect concrete barrier or bridge parapet with less than 125 feet of longitudinal space in front of hazard.

Name: Name: BEAT-SSCC from, Road Systems Inc., www.roadsystems.com

Local supplier: Universal Industrial Sales, Pleasant Grove, Utah phone: (801) 785-0505

<http://www.universalindustrialsales.com/>

Molly Weight, Sales Consultant, e-mail molly@uismail.com



Length:

28 feet

Width:

18 inches @ impact head

NCHRP Test Level:

TL-3, may be used at any speed limit

Length of Need:

Starting at post # 3, 14 feet from front of system

Characteristics

Re-directive, unidirectional, gating. The impact heads slides into the box beam elements and splits the beam; dissipate the energy from an impacting vehicle.

The system uses ground mounted steel breakaway post or surface mounted steel posts.

Applications

Use to protect concrete barrier and bridge abutments with longitudinal space of less than 125 feet in front of hazard.

Requirements

System attaches directly to concrete barrier or bridge parapet. Use only manufacturer's supplied ground mounted breakaway or surface mounted posts. Install post as per manufacturer's requirements. Slopes of 10:1 or less are required to the front and side approaches, and be free of obstacles. Refer to UDOT STD DWG CC 7B Crash Cushion Type "F" for recovery area and slope requirements behind the system. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all applications.

Type F (continued)

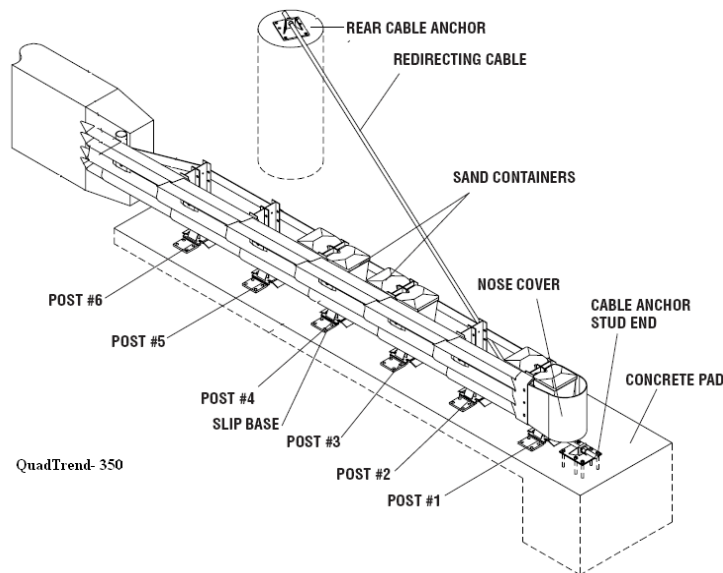
Name: QuadTrend 350™ from Energy Absorption Systems

www.energyabsorption.com/products/permanent/QuadTrend350System.htm

Local supplier: Interwest Safety Supply, Inc. Provo, Utah phone: (801) 375-6321

<http://www.interwestsafety.com/store/categoryView.aspx?idCategory=7>

Greg Robison, Sales Consultant, e-mail grobison@iwsafety.com



Length: 21 feet

Width: 1 foot 3 inches

NCHRP Test Level: TL-3, may be used with any speed.

Length of Need: Starting at post # 3, 7 feet 6 inches from front of system (nose piece)

Characteristics:

Re-directive, uni-directional, gating. This system is equipped with a slip base steel post and sand containers, which work in conjunction with one another to dissipate the energy from an impacting vehicle.

Application:

Use to protect concrete barrier and bridge abutments with longitudinal space of less than 125 feet in front of hazard.

Requirements:

Construct concrete pad as per manufacturer's requirements. Use manufacturer's requirements for installing redirecting cable and cable anchor. Redirecting cable anchor will be positioned in such a manner as to allow the redirecting cable to lay flat on the ground. Slopes of 10:1 or less are required to the front and side approaches, and be free of obstacles. Refer to UDOT STD DWG CC 7A Crash Cushion Type "F" for recovery area requirements behind the system, and redirecting cable anchor requirements.

When system is installed with New Jersey shaped barrier a barrier modification is required. See Standard Drawing CC 7A for this modification.

The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD DWG CC 1. The object marker plate and marker post will not be a separate pay item and must be installed in all applications.

Type G (2 approved systems)

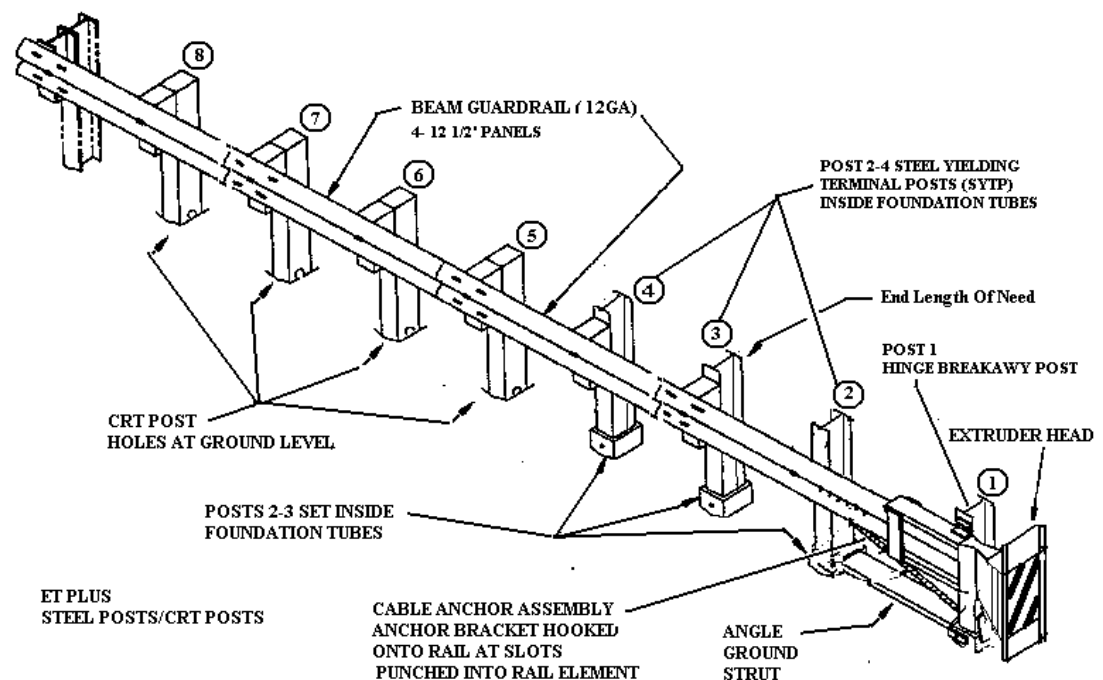
(The systems in this type look very similar: see characteristics to distinguish differences.)

Use to protect the approach end of single face w-beam guardrail. Should be used to protect concrete barrier or bridge parapet with unlimited longitudinal space (125 feet or greater) in front of the hazard when proper transition element is installed. These systems used on tangent or flared barrier installations.

Name: ET-PLUS™ from, Trinity Highway Products, Inc. www.highwayguardrail.com

Local supplier: Trinity Industries, Inc. Centerville, Utah phone: (801) 292-4461

Sales Consultant : Ralph Evans, email ralph.evans@trin.net



Length: 50 feet

Width: 1 foot 8 inches (extruder head)

NCHRP Test Level: TL-3, may be used with any speed.

Length of Need: starting with post #3, 12 feet 6 inches from front of system

Offset:

When used on a tangent barrier installation a 2-foot (25:1) straight-line flare over the length of the system required.

Characteristics

Re-directive, unidirectional, gating. Extruder head flattens the rail, which is pushed out the backside of the head. The cable box anchor assembly is hung on the first rail element using rectangular slots punched into the rail element. The extruder head chute **does not** extend to the cable box assembly attachment point. The extruder head appears to be solid.

Application

Single faced guardrail may be attached to bridge parapet or concrete barrier using a transition element, refer to STD DWG BA 4 series. This system can be used with tangent or flared barrier installations.

Requirements

W-Beam Rail element: 4- 12½' w-beam guardrail elements. Each rail element punched and drilled as per manufacturer's requirements. First rail element punched and drilled as per manufacturer's requirements. Rail panels 2-4 standard w-beam rail elements.

Line Post for new construction:

Steel post: Installation will use a Hinged Breakaway steel post (HBA™), and Steel Yielding Terminal Posts (SYTP) as specified by the manufacturer at the location indicated below.

Posts 1: lower section of Hinged Breakaway posts (HBA™) is 71½ inches in length, upper post is 28 inches in length. The post sections are bolted together. Hinge joint will be placed a maximum of 1 inch above ground line. Hinge section of post will not be placed below ground level. Post block not required at posts 1. Angle ground strut required between posts 1 and 2.

Posts 2: shortened Steel Yielding Terminal Post (SYTP) set into 6-foot foundation tube, no blockout.

Post 3 and 4: shortened Steel Yielding Terminal Posts (SYTP) set into 4 foot 6 inch foundation tubes. **The top of the foundation tubes will not be more than 4 inches above the ground line.**

Notched wood or composite blocks are required at posts 3 and 4.

Use only manufacturer specified Steel Yielding Terminal Posts (SYTP).

Posts 5 through 8: standard wood Controlled Release Terminal (CRT) posts.

The Hinged Breakaway Post (HBA™) and Steel Yielding Terminal Posts (SYTP) used with this system cannot be substituted with any other type of steel breakaway post.

Transition required, as per UDOT STD DWG BA 4B for attachment to concrete barrier or bridge parapet, which will add a length of 25 feet to the installation. System will be installed with a 25:1 offset over the 50-foot length of the system. This will keep the extruder head from encroaching onto the shoulder of the roadway. The 25:1 offset may start at the connection point of the transition element if installed onto concrete barrier or bridge parapet.

Refer to UDOT STD DWG CC 8A and CC 8B Crash Cushion Type G for offset requirements, grading requirements and recovery area requirements. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD DWG CC 1.

Repair option on next page

Repair options: existing ET 2000 and ET Plus

Option 1: system with 8 foundation tubes

1. Post 1: remove foundation tubes replace with system manufacturer's specified Hinge Breakaway Post (HBA™) and angle ground strut.
2. Posts 2 through 8: replace damaged shortened wood posts with system manufacturer's specified shortened Steel Yielding Terminal Post (SYTP).
 - a. Replace wood blocks with notched wood or composite block.
3. If some of the existing wood posts are serviceable move to rear of system. Place steel post together near front of system.
 - a. Replace wood blockout as needed.
4. Replace damaged rail elements with 12½' rail elements.
 - a. First rail element punched and drilled as per manufacturer's requirements.

Option 2: systems with 4 foundation tubes

1. Post 1: remove foundation tubes replace with system manufacturer's specified Hinge Breakaway Post (HBA™) and angle ground strut.
2. Posts 2 through 4: replace damaged shortened wood posts with system manufacturer's specified shortened Steel Yielding Terminal Post (SYTP).
 - a. If some of the existing wood posts are serviceable move to rear of system. Place steel post together near front of system.
 - b. Replace wood blocks with notched wood or composite block.
3. Post 5 through 8: replace standard wood Controlled Release Terminal (CRT) posts in kind.
 - a. Replace wood blocks as needed.
4. Replace damaged rail elements with 12½' rail elements.
 - a. First rail element punched and drilled as per manufacturer's requirements.

ET/Plus: with steel posts and standard wood Controlled Release Terminal (CRT) posts

Option:

1. Post 1: repair/remove damaged hinged breakaway post
 - a. Replacement made with system manufacturer's specified post only (HBA).
 2. Post 2 and 4: replace damaged shortened Steel Yielding Terminal Post (SYTP). Replace damaged foundation tube if required
 - a. Replace steel post with manufacturer's specified Steel Yielding Terminal Post (SYTP) only.
 - b. Replace wood blocks as needed.
 3. Post 5 through 8: replace with standard wood Controlled Release Terminal (CRT) posts.
 - a. Replace wood blocks as needed.
 4. Replace damaged rail elements with 12½' rail elements.
 - a. First rail element punched and drilled as per manufacturer's requirements.
-

Type G (continued)

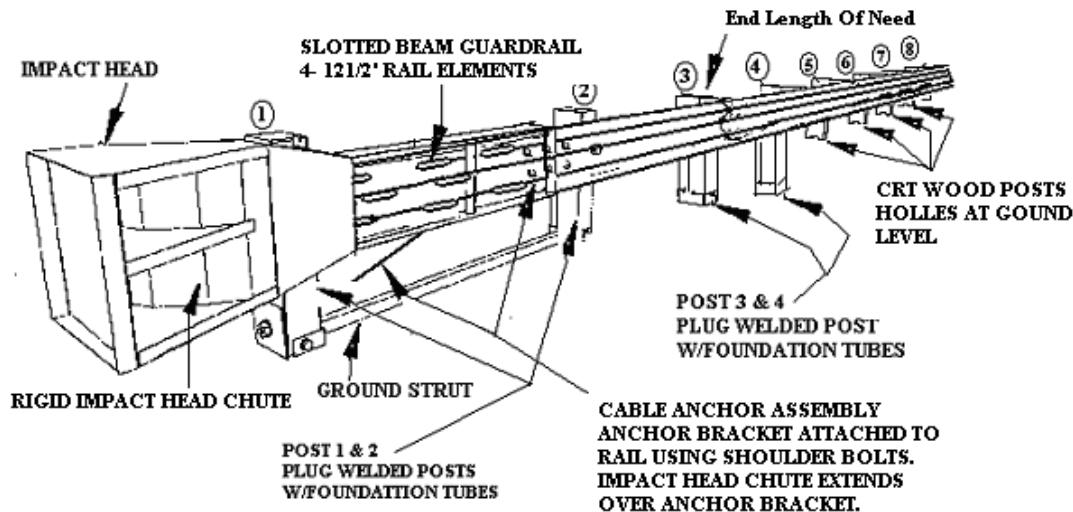
Name: SKT-350 from Road Systems Inc., www.roadsystems.com

Local supplier: Universal Industrial Sales, Pleasant Grove, Utah phone: (801) 785-0505

<http://www.universalindustrialsales.com/>

Molly Weight, Sales Consultant, e-mail molly@uismail.com

**SKT-350
STEEL POST/CRT WOOD POSTS**



Length: 50 feet

Width: 1 foot 8 inches @ impact head

NCHRP Test Level: TL-3 may be used with any speed.

Length of Need: Starting with post #3, 12 feet 6 inches from front of system.

Offset:

When used on a tangent barrier installation a 2-foot straight-line flare (25:1) over the length of the system required.

Characteristics

Re-directive, unidirectional, gating. Impact head kinks the rail element, which is pushed out the backside of the head. The cable box anchor assembly is attached to the first rail element using shoulder bolts and sliding over the bolts. The impact head chute extends to the cable box assembly attachment point. The impact head is attached to the chute assembly leaving an open space between the face of impact head and chute.

Application

Single faced guardrail may be attached to bridge parapet or concrete barrier using a transition element, refer to STD DWG BA 4 series. This system can be used with tangent or flared barrier installations.

Requirements

W-Beam Rail element: 4- 12 1/2' w-beam guardrail elements. First rail element punched and drilled as per manufacturer's requirements. Panels 2 through 4, standard 12 1/2' w-beam guardrail.

Line Post for new construction:

Steel post: Installation will use steel plug welded and standard wood Controlled Release Terminal (CRT) posts as specified by the manufacturer at the location indicated below.

This system uses W6 X 8.5 X 45" steel plug welded posts.

Post 1 and 2: 6' 0" foundation tubes, with 45" steel plug welded posts, no blockouts

Post 3 and 4: 4' 6" foundation tubes, with 45" steel plug welded posts, notched wood or composite blockouts.

Posts 5 through 8: standard wood Controlled Release Terminal (CRT) posts with blockouts.

Transition required, as per UDOT STD DWG BA 4B for attachment to concrete barrier or bridge parapet, which will add a length of 25 feet to the installation. System will be installed with a 25:1 offset over the 50-foot length of the system; this will keep the impact head from encroaching onto the shoulder of the roadway. The 25:1 offset may start at the connection point of the transition element if installed onto concrete barrier or bridge parapet. Refer to UDOT STD DWG CC 8A and CC 8B Crash Cushion Type G for offset requirements, grading requirements and recovery area requirements. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD DWG CC 1.

Repair options: SKT-350 systems

Systems with all wood posts and 4 foundation tubes:

1. Post 1 through 4: replace damaged posts with shortened plug welded post.
 - a. Use manufacturer's specified plug welded post only.
 - b. If some of the existing shortened wood posts are serviceable move to rear of system. Place steel post together near front of system
 - c. Replace wood blocks as needed.
2. 5 through 8: replace standard wood Controlled Release Terminal (CRT) posts in kind.
 - a. Replace wood blocks as needed.
3. Replace damaged rail elements with 12½' rail elements.
 - a. First rail element punched and drilled as per manufacturer's requirements.

Systems with plug welded posts and standard wood Controlled Release Terminal (CRT) posts.

1. Post 1 through 4: replace damaged shortened plug welded post with manufacturer's specified post.
 - a. Replace wood blocks as needed.
2. 5 through 8: replace standard wood Controlled Release Terminal (CRT) posts in kind.
 - a. Replace wood blocks as needed.
3. Replace damaged rail elements with 12½' rail elements.
 - a. First rail element punched and drilled as per manufacturer's requirements.

Type H (3 approved systems)

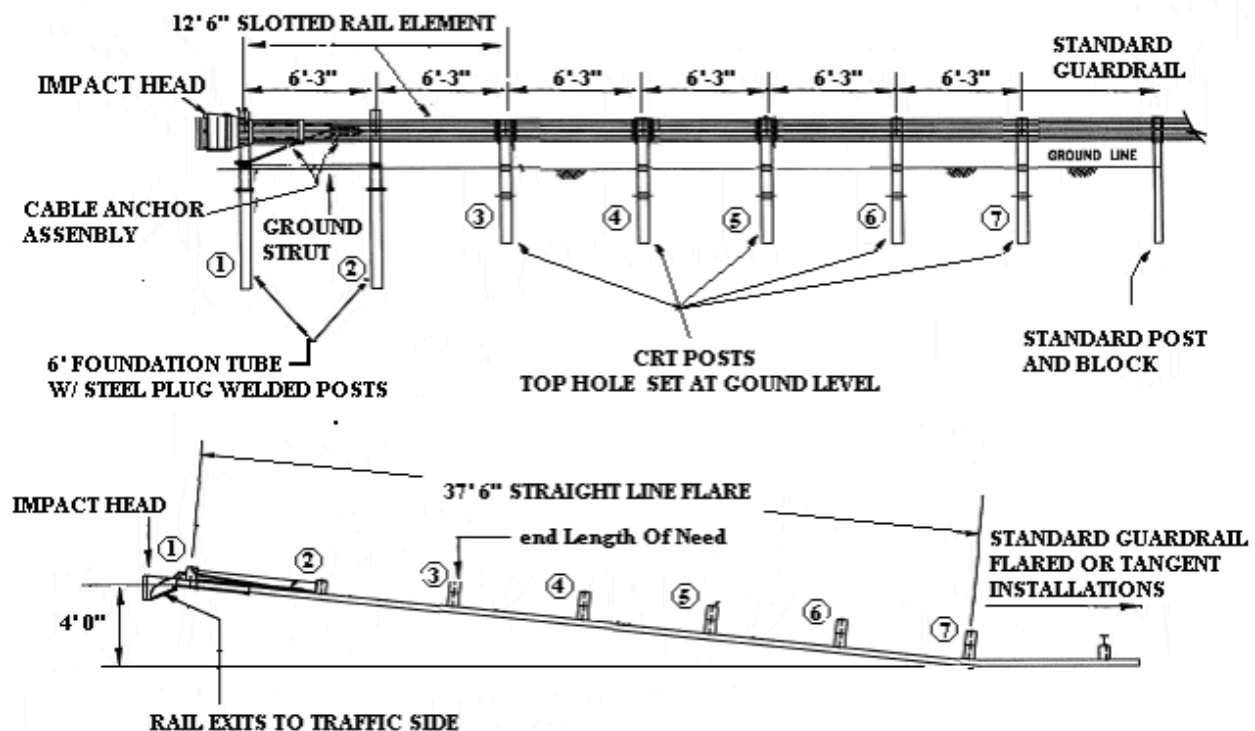
Primarily used when protecting the approach end of single face w-beam guardrail. Should be used to protect concrete barrier or bridge parapet with unlimited longitudinal space 125 feet in front of the hazard when proper transition element is installed. These systems used on tangent or flared barrier installations.

Name: FLEAT-350 from Road Systems, Inc. www.roadsystems.com

Local supplier: Universal Industrial Sales, Pleasant Grove, Utah phone: (801) 785-0505

<http://www.universalindustrialsales.com/>

Molly Weight, Sales Consultant, e-mail molly@uismail.com



FLEAT -350

Length: 37 feet 6 inches

Width: 14 inches @ impact head

NCHRP Test Level: TL-3, may be used with any speed.

Offset:

When used on a tangent barrier installation a 4 foot straight line flare over the length of the system required.

When system is used on a flared barrier installation, system will be installed at the same flare rate of the barrier installation.

Length of Need: Starting with post #3, 12 feet 6 inches from front of system

Application

Tangent or flared, single faced guardrail installations. When used to protect concrete barrier or bridge parapet, a transition is required as per UDOT STD DWG BA 4 series.

Characteristics

Re-directive, unidirectional, gating. The impact head slides over the rail element and when impacted the head kinks the rail element, absorbing the energy from the impacting vehicle, the rail is then pushed out the front side of the head. The cable box anchor assembly is attached to the first rail element using shoulder bolts and sliding over bolts.

Requirements

Line Posts for new construction:

Steel post: Installation will use steel plug welded and standard wood Controlled Release Terminal (CRT) posts as specified by the manufacturer at the location indicated below.

This system uses W6 X 8.5 X 45" steel plug welded posts.

Posts 1 and 2: 6' 0" foundation tubes, with 45" steel plug welded posts, no blockouts

Posts 3 through 7: standard wood Controlled Release Terminal (CRT) posts with blockouts

W-Beam Rail element: 3- 12½' w-beam guardrail elements. First rail element punched and drilled as per manufacturer's requirements. Panels 2 through 3, standard 12½' w-beam guardrail.

Transition required, as per UDOT STD DWG BA 4 series, for attachment to concrete barrier or bridge parapet. Refer to UDOT STD DWG CC 9A Crash Cushion Type H for offset requirements, grading requirements and recovery area requirements. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1.

Repair options: existing FLEAT-350 systems

Wood post system with 2 foundation tubes

1. Post 1 and 2: replace wood posts with shortened plug welded post.
 - a. Use manufacturer's specified plug welded post only.
2. Posts 3 through 7: replace damaged standard wood Controlled Release Terminal (CRT) posts in kind.
 - a. Replace wood blockout as needed.
3. Replace damaged rail elements with 12½' rail elements.
 - a. First rail element punched and drilled as per manufacturer's requirements.

Steel post systems

1. Post 1 and 2: replace damaged plug welded posts.
 - a. Use manufacturer's specified plug welded post only.Post 3 through 7: replace damaged standard wood Controlled Release Terminal (CRT) posts with blockouts in kind.
2. Replace damaged rail elements with 12½' rail elements.
 - a. First rail element punched and drilled as per manufacturer's requirements.

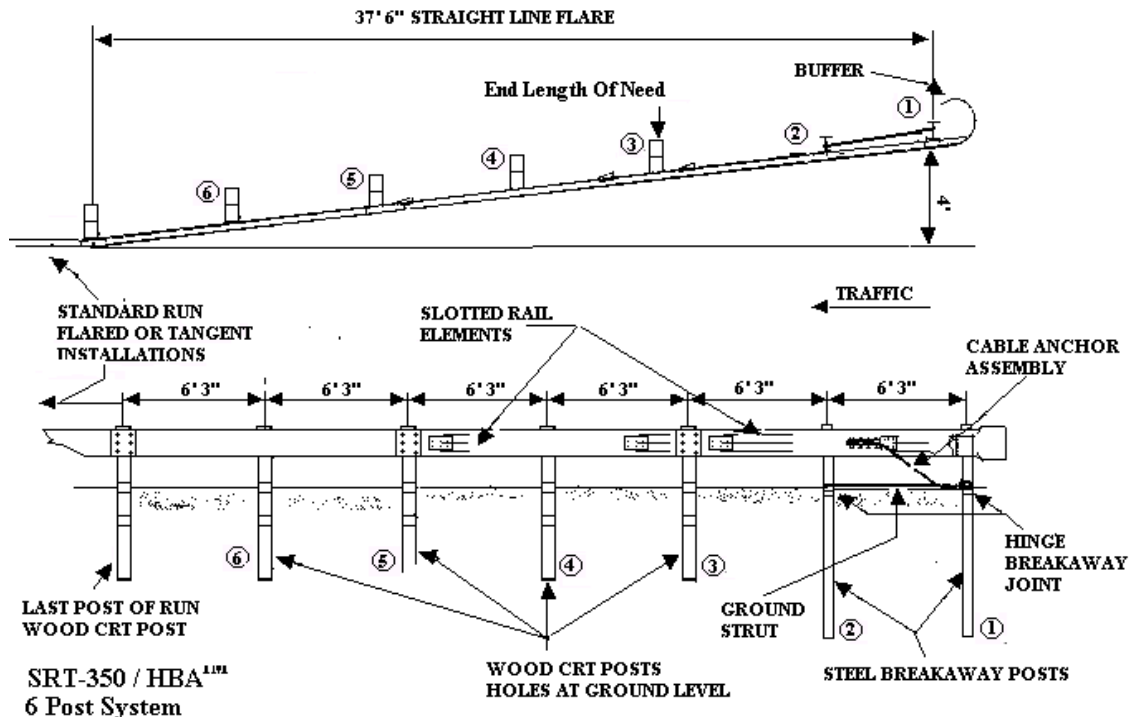
Type H (continued)

Name: SRT™/HBA™ 6 Post System, Trinity Highway Products, Inc.

www.highwayguardrail.com

Local supplier: Trinity Industries, Inc. Centerville, Utah phone: (801) 292-4461

Sales Consultant : Ralph Evans, email ralph.evans@trin.net



Note: The last line post of the guardrail installation or the last post of the transition element (post 11), at the point of the SRT-350/HBA is connected will be a standard wood Controlled Release Terminal (CRT) post, and is not considered part of the system. When this system is bid and selected, the contractor will insure the standard wood Controlled Release Terminal (CRT) post at this location is installed.

Length: 37 feet 6 inches

Width: Width is same as standard guardrail

NCHRP Test Level: TL-3, may be used with any speed.

Offset

When used on a tangent barrier installation a 4 foot straight line flare over the length of the system required.

When system is used on a flared barrier installation the system offset will be 4 foot, measured from the barrier flare rate extended.

Length of Need: Starting with post #3, 12 feet 6 inches from front of system.

Characteristics

Re-directive, uni-directional, gating.

Application:

Single faced guardrail may be attached to bridge parapet or concrete barrier using a transition element, refer to STD DWG BA 4 series. This system can be used with tangent or flared barrier installations. When used with a tangent barrier an offset of 4' from barrier line extended required, when used with a flared barrier system the offset will be 4' from the flared barrier line extended.

Requirements**Line Posts**

Posts 1 and 2: use Hinged Breakaway (HBATM) Post as supplied by the manufacturer. The posts are constructed in two pieces and bolted together at the hinge point, The lower sections are 71½ inches in length and the uppers section is 43½ inches in length. Post 1 and 2 do not require a block. Angle ground strut required between posts 1 and 2.

The joint of post will be placed a maximum of 1 inch above ground line and will not be placed below ground level.

The Hinged Breakaway Post (HBATM) used with this system cannot be substituted with any other type of steel breakaway post.

Post 3 through 6: standard 72 inch standard wood Controlled Release Terminal (CRT) posts, the bottom of the top hole will be placed at ground level.

The last line post of the guardrail installation or the last post of the transition element (post 11), will be a standard wood Controlled Release Terminal (CRT) post at the connection point of the SRT-350/HBA. This post is not considered part of the system. When this system is bid and selected the contractor will insure that the standard wood Controlled Release Terminal (CRT) post at this location is installed.

Transition required, as per UDOT Standard Drawing BA 4 series, for attachment to concrete barrier or bridge parapet. Refer to UDOT Standard Drawing CC 9A, End Section Type H, for grading and recovery area requirements. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1.

W-Beam Rail element: 3- 12½' w-beam guardrail elements. First and second rail element punched with longitudinal slots and drilled as per manufacturer's requirements. Rail element 3 is standard 12½' w-beam guardrail. Post 2 requires a back up plate.

Repair options: existing SRT/HBA repair as installed.

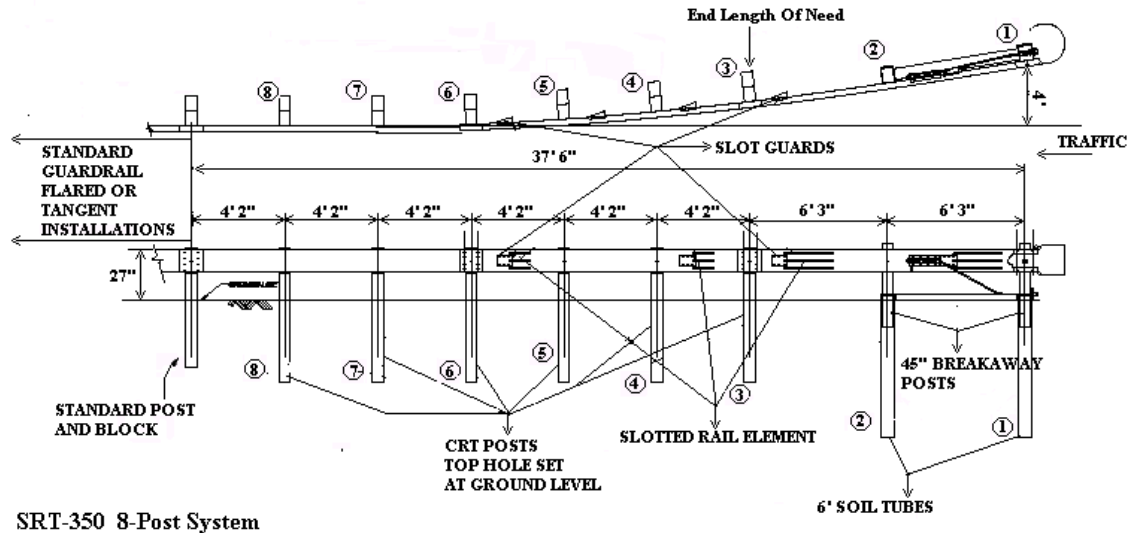
Type H (continued)

Name: SRT-350™ 8 Post System, Trinity Highway Products, Inc.

www.highwayguardrail.com

Local supplier: Trinity Industries, Inc. Centerville, Utah phone: (801) 292-4461

Sales Consultant : Ralph Evans, email ralph.evans@trin.net



Length: 37 feet 6 inches

Width: Width is same as standard guardrail

NCHRP Test Level: TL-3, may be used with any speed.

Length of Need: Starting with post #3, 12 feet 6 inches from front of system.

Offset: 4 foot parabolic flare over the length of the system.

Characteristics: Re-directive, uni-directional, gating

Application: Single faced guardrail

Requirements:

Posts 1 and 2: 72 inch foundation tubes with 2, 45 inch wood breakaway posts. Posts 1 and 2 do not require a block. Angle ground strut required between posts 1 and 2.

Posts 3 through 8: standard wood Controlled Release Terminal (CRT) posts, the bottom of the top hole will be placed at ground level.

The foundation tubes will be no greater than 4 inches above ground level.

Transition required, as per UDOT Standard Drawing BA 4B, for attachment to concrete barrier or bridge parapet. Refer to UDOT Standard Drawing CC 9B, End Section Type "H", SRT-350, for grading and recovery area requirements. The manufacturer, supplier or installer of the system will provide the appropriate directional object panel and marker post, UDOT STD. DWG CC 1.

W-Beam Rail element: 3- 12½' w-beam guardrail elements. First and second rail element punched and drilled as per manufacturer's requirements, post 2 requires a back up plate. Panel 3, standard 12½' w-beam guardrail.

Repair options: existing SRT-350 repair as installed.

References

NCHRP Report 350 - Recommended Procedures for the Safety Performance Evaluation of Highway Features

NCHRP Report 230 - Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances

NCHRP Synthesis 205- Performance and Operational Experience of Crash Cushions

Design Construction and Maintenance of Highway Safety Features, NHI, 1997

Guide to Standardized Highway Barrier Hardware, Task Force 13 Report, AASHTO

Roadside Design Guide, 2002, AASHTO

Barrier Systems, Inc, Design and Installation Manuals

Energy Absorption Systems, Inc., Design and Installation Manuals

Road Systems, Inc, Design and Installation Manuals

SCI Products Inc., Installation and Repair Manual

Trinity Highway Products Inc., Design and Installation Manuals

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Mr. Martin Snow, Universal Industrial Sales., Lindon, UT

Mr. Bryce Sorenson, Interwest Safety Supply, Provo, UT